WIND ON THE WIRES: **Responses to Questions posted to Michigan Energy Forum Website**

6. How can reliability costs and benefits be assessed and incorporated into an analysis of renewables costs? Has any jurisdiction tried to do so, and if so, how?

A report analyzed the cost of integrating between 15% and 25% of wind generation into Minnesota. The study includes the cost of integration and variability into the analysis of renewable energy costs. The results showed that, relative to the same amount of energy stripped of variability and uncertainty of the wind generation, there is a cost paid by the load that ranges from a low of $2.11 (for 15% wind generation, based on year 2003) to a high of $4.41(for 25% wind generation, based on year 2005) per MWH of wind energy delivered to the Minnesota companies. This is a total cost and includes the cost of the additional reserves (per the assumptions) and costs related to the variability and day-ahead forecast error for wind generation. (EnerNex, *Final Report-2006 Minnesota Wind Integration Study*, vol. I at XX-XXI (Nov. 30, 2006)).

The NREL *2011 Wind Technologies Market Report* also calculates the integration costs per MWh for wind penetrations up to 40% as being less than $12/MWh and often below $5/MWh. (NREL, *2011 Wind Technologies Market Report* at 65 (August 2012)). Factors that keep the cost of integration down are having large balancing areas, like MISO, the use of wind power forecasts, intra-hour dispatch scheduling. All of which are being used by MISO.

Some people assert that you need one megawatt of gas in reserve for wind megawatt of wind for when the wind stops blowing. That is incorrect. NREL looked into this and found that the increase in balancing reserves needed for wind is typically less than 15% of the nameplate capacity of wind. (NREL, *2011 Wind Technologies Market Report* at 66.)

We also note that PJM is conducting an integration study that is expected to be released in 2013. The report is titled "*Review of Industry Practice and Experience in the Integration of Wind and Solar Generation.*" That study examines a number of scenarios for various levels and combinations of penetrations of various technologies including solar and land-based and offshore wind. It provides PJM with a comprehensive look at the best approaches for integrating wind and solar power, based on an examination of operations and processes being implemented around the country and the world. The report covers energy scheduling, imbalances, reserves, contingency reserves, wind and solar forecasting, active power management and determining the capacity value of variable generation.

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